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DESCRIPTION OF A NEW SPECIES OF EARTHWORM (*DIPLOCARDIA LONGA*)  
FROM GEORGIA.

BY J. PERCY MOORE.

Forming part of a small collection of earthworms gathered by Mrs. T. W. Walker in Pulaski county, Georgia, and secured for the Academy through the interest of Mr. Joseph Willcox, are seven specimens of a hitherto unnoticed species of *Diplocardia*. Its most distinctive feature is found in the coexistence of the second gizzard and the first pair of spermathecae in the same somite, in which respect it is unique among known species of the genus. In the presence of the gizzards in somites VI and VII it resembles *D. michaelsoni*, but differs from that species in the possession of three pairs of spermathecae. The latter character and numerous others which appear in the following description evidently ally it to the *communis* group, but the great number of segments, high level of the nephridial openings, form of the spermathecae, etc., are diagnostic.

*Diplocardia longa* n. sp.

Size of *D. communis*; length in moderate extension up to 275 mm.; diameter at VII 5 mm., behind the clitellum 4 mm. Number of segments 270 to 330. Form slender, terete throughout; diameter increasing to VII, then diminishing to the clitellum which is slightly enlarged and prominent, then narrowing a little and remaining nearly uniform to near the end, where a slight club-shaped enlargement precedes a final shrinkage to the anal ring.

Prostomium very short, broad and nearly truncate, in most specimens scarcely projecting beyond the peristomium into which it is tenoned for about one-half the length of the latter. The exact form, however, differs in the several specimens; in some the two sides nearly meet within the peristomium; in others they are more nearly parallel and may be continued by grooves nearly to the posterior border of the latter, or they may merge into transverse grooves. Both prostomium and peristomium are much marked above with longitudinal wrinkles and the former has a deep ventral furrow.

The somites increase in length to VII, and then diminish to about one-half in the postclitellial region, after which they change but little

till the posterior end is approached. Somites II and III are simple; IV is biannulate, with the furrow just behind the setæ and consequently nearer to the posterior margin; V has a median setigerous annulus partially cut off from the larger annulus. The remaining preclitellial segments are conspicuously triannulate, the middle or setigerous annulus being the narrowest but most prominent. Occasionally the first annulus is again subdivided into two. When the clitellum is present, as in most of the specimens, the segments of this region are smooth and undivided, dorsally at least, but in immature worms the annulation appears here also. In all but the most posterior of the postclitellial somites also the triannular structure is apparent, but is generally inconspicuous except in the more anterior ones or those strongly contracted.

The usual four pairs of setæ are present on all somites except the peristomium, a few preanal, and XIX, the latter of which lacks the ventral pairs only. All are strictly paired and strongly ventral in position, but the intervening spaces vary somewhat. On XVI the setal formula is  $a-b < \frac{1}{4} a-a$ ,  $a-a = 2\frac{1}{2} c-d$ ,  $a-b = \frac{3}{5} c-d$ ,  $b-c < a-a$ ,  $d-d =$  about  $\frac{2}{3}$  semi-circumference. Ordinary setæ stout, sigmoid, blunt-pointed, thickened distad of middle, the outer end slightly sculptured with a reticulum of fine lines giving to the setæ an appearance of being covered with delicate scales. Spermathecal copulatory setæ (the ventral ones on VII, VIII and IX) similar but with much bolder sculpturing and apparently unaccompanied by special glands. Penial setæ (the ventral ones on XVIII and XX) capillary, tapering, somewhat thickened within the body-walls, with slight sinuous curvatures, especially near the end, which may be slightly hooked. They are about twice as long, or somewhat more, than the ordinary setæ, and only  $\frac{1}{3}$  to  $\frac{1}{4}$  as thick. Near the end is a sculptured region marked with close transverse lines appearing as fine notches on the profiles, but the end itself for a considerable distance is smooth or longitudinally striated.

Dorsal pores begin at  $\frac{IX}{X}$  or usually  $\frac{X}{XI}$  and are conspicuous. The position of the nephridiopores is remarkable in being widely removed from the dorsalmost seta; while the former are situated at approximately the two ends of the transverse diameter of the body the latter are fully  $15^\circ$  to  $30^\circ$  below these points. Successive nephridiopores are usually alternately at a little higher and lower level and are on the extreme anterior borders of the somites—almost in the furrows—the first on III. Spermathecal pores are less easily found. They occur in line with seta  $a$  on the anterior part of somites VII, VIII and IX, and are consequently presetal and postseptal.

Though present in all but one, the clitellum is perfectly developed only in the largest specimen. It covers seven segments, XIII to XIX inclusive, and is completely annular and of uniform thickness on the first five, but interrupted or much thinner on the middle ventral region of the last two. On the posterior clitellial and several of the immediately succeeding segments occur certain papillæ and grooves utilized during copulation. Two pairs of papillæ, situated on the posterior part of XVII or on  $\frac{XVII}{XVIII}$  and on the posterior part of XX or  $\frac{XX}{XXI}$ , are constant on all of the specimens; a third pair situated on XXI or  $\frac{XXI}{XXII}$  is complete in one specimen, represented by a median papilla in one, by the left only in three specimens, by the right only in one, and is totally absent in the seventh, in which, however, indistinct thickened areas appear in the median field of  $\frac{XXI}{XXII}$  and  $\frac{XXII}{XXIII}$ . In one specimen a small median papilla is present on XVII between those of the pair. When the papillæ overlap the contiguous borders of two segments, which is the normal condition, the affected furrows are obliterated ventrally. In most cases the first pair of papillæ are much the largest and the third the smallest, but in this respect also they are variable. All of the papillæ are low, broad disks of an irregular elliptical or sometimes circular form. The central portion is more translucent and either elevated or depressed above the more opaque, firmer rim which contains a circle of glands. The entire structure of these papillæ indicates that in addition to a secretory adhesive function of the rim the center acts as a true vacuum sucker. Just anterior and posterior to each pair of suckers transverse grooves usually extend across the venter and other shorter and less constant ones may occur. Very constant and conspicuous are a pair of longitudinal grooves reaching in the line of the ventral setæ from the middle of XVIII to the middle of XX. Each groove consists of three parts: a short anterior section reaching from the setæ of XVIII to the furrow  $\frac{XVIII}{XIX}$ , a longer middle section extending for the entire length of XIX, and a short posterior section completing the groove to the setæ of XX. All three sections are strongly curved, the anterior and posterior with the convexity outward, the middle with the convexity directed inward. At the point of junction of the anterior and middle sections, in the furrow  $\frac{XVIII}{XIX}$ , the groove enlarges into a small triangular sinus containing a minute papilla upon which the male pore opens. This is perhaps situated rather more on XIX than XVIII. At each end of the groove and just external to the closely approximated penial setæ of somites XVIII and XX are the external openings of the two pairs of prostate glands, the secretion of which is therefore brought to the sperm by means of this groove. The

female pores are situated close together between the ventral setæ of XIV, but are invisible in surface views.

No complete cœlomic septa exist anterior to  $\frac{V}{VI}$ , this space being largely occupied by the radiating pharyngeal muscles;  $\frac{XII}{XIII}$  is slightly thickened,  $\frac{VI}{VII}$  and  $\frac{XI}{XII}$  about twice as thick, and  $\frac{VII}{VIII}$  to  $\frac{X}{XI}$  each about four times as thick as ordinary septa and extremely muscular. From  $\frac{VI}{VII}$  to  $\frac{VIII}{IX}$  the septa are strongly funnel-shaped and "nested." The pharynx occupies III and IV, a short œsophagus V, the strongly muscular gizzards VI and VII; then follows a straight narrow canal which appears to lack calciferous pouches, but is slightly enlarged with yellowish, thickened and very vascular walls in the posterior part of X and presents a similar but less pronounced structure in XI. The true sacculated intestine begins in XVIII. The anus is a wide vertical slit. The brain is transverse, about five times as wide as long, without median constriction or any lobing, and is situated in II. The ventral cord is remarkable for the complete and extremely thick muscular sheath, which equals  $\frac{1}{2}$  the diameter of the cord proper at a ganglionic enlargement. Although present in other species of *Diplocardia*, the muscular sheath is in this one thicker than usual. Apparently there are no peculiarities of the vascular system. Unlike the type species the dorsal vessel is single and undivided throughout in the three examples dissected. Strongly enlarged hearts occur in XIII, and a slightly enlarged pair in XII. The nephridia begin in III, and appear to be present in every succeeding somite. Except for the first five pairs, which are more compactly coiled and of smaller size, they have the long-looped form described for other species of the genus.

Three pairs of spermathecæ exist in the anterior parts of somites VII, VIII and IX, attached to the body floor at the base of the corresponding septa, behind which they rise freely to a high level, though occasionally they pass through the neural arch of the septum into the preceding somite. All of the spermathecæ have the pouch and stalk very distinctly differentiated and are especially characterized by the great length of the latter and the very low position of the diverticulum which arises from its lateral side at the point at which it enters the body wall. The pouch has in general the form shown in fig. 1, which represents the second spermatheca, and in all of the specimens examined is strongly flattened laterally. The stalk is at least as long as and usually longer than the pouch, and also more or less flattened by the pressure of the

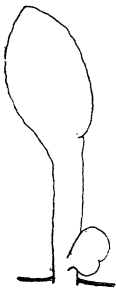


Fig. 1

neighboring organs. The flat, spreading diverticulum opens into the base of the stalk by a short, narrow duct. In three specimens dissected the pouch increases in size successively from the first to the third spermatheca and the diverticulum diminishes correspondingly. While completely divided into two or even three lobes in the first, the latter is in the second and third either simple or very faintly bilobed.

The testes occupy the usual position in somites X and XI, and two pairs of sperm sacs are borne on the anterior face of septum  $\frac{IX}{X}$  and the posterior face of septum  $\frac{XI}{XII}$ . The latter are much and deeply lobulated, having the aspect of dense tufts of broadly clavate or stalked spheroidal bodies. The sperm funnels lie in somites X and XI attached to the posterior septa near the coelomic floor and close to the ventral nerve cord. They are of simple form and consist chiefly of a pair of broad lobes partly folded together like the two lobes of a *Dionæa* leaf. After penetrating the septa the vasa deferentia plunge at once into the longitudinal muscular layer of the body wall which they penetrate to a depth of about  $\frac{1}{5}$  of its thickness, and continue at this level in the line of the ventral setæ to a point near the male gonopore, when they bend sharply outward toward the surface. Throughout their course the two vasa deferentia of each side lie side by side, but are perfectly distinct until quite at the external orifice, where they coalesce at a common opening. The ovaries are conspicuous, fimbriated, fan-shaped structures consisting of numerous chains of ova attached to the posterior face of septum  $\frac{XII}{XIII}$ . Trumpet-shaped oviducts, the mouths of which are formed very much like the sperm funnels, perforate the septum  $\frac{XIII}{XIV}$ , and at once penetrate the body floor obliquely backward and inward. Near the external surface they bend sharply toward the median line and open in the setæ zone on the ventral surface of XIV, separated by an interval of about  $\frac{1}{4}$  *a-a* or less than the transverse diameter of the nerve cord with its sheath. The external pores are so small that they can be detected only in sections. The prostate glands (fig. 2) are large and conspicuous, and are variously folded sharply back and forth several times within the limits of the single segments XVIII

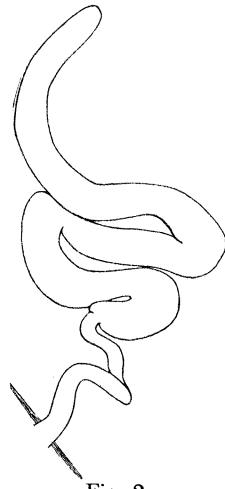


Fig. 2.

and XX which the two pairs respectively occupy. The glandular portion and the muscular duct are sharply differentiated, and the latter arises directly from the end of the former. The former is about three times as thick and three and one-half times as long as the latter, cylindrical and tubular, with a distinct lumen throughout and thick walls composed of gland cells in various stages of activity.

The integuments are translucent and the colors dull in life. The anterior and usually the extreme posterior ends are hair brown, varying in shade; the clitellum is russet, and the remainder of the body nearly salmon pink or sometimes ceru. Through the less pigmented portions of the skin the blood vessels show conspicuously of a deep purple color. These worms are very sluggish, but may be stimulated to greater activity by exposure to light, which they seek to avoid. They occur in moist sandy soil.